CAIT
Center for Advanced Infrastructure & Transportation
Rutgers, The State University of New Jersey

QUARTERLY PROGRESS REPORT

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| Project Title: | Flexible Overlays for Rigid Pavements |
| RFP NUMBER: 200X-XXX | NJDOT RESEARCH PROJECT MANAGER: NJDOT Project Manager |
| TASK ORDER NUMBER: TO 184 / RU Acct 4-26554 | PRINCIPAL INVESTIGATOR(S): Dr. Ali Maher/Mr. Thomas Bennert |
| Project Starting Date: 1/1/2006<br>**Original** Project Ending Date: 12/31/2007<br>**Modified Completion Date:** | Period Covered: 1st Quarter 2007 |

| Task # | Task | % of Total | Fixed Budget | % of Task this quarter | Cost this quarter | % of Task to date | Total cost to date |
|---|---|---|---|---|---|---|---|
| 1 | Mobilization | 6.80% | $ 45,000.00 | 0.0% | $ - | 100.0% | $ 45,000 |
| 2 | Literature Search | 2.70% | $ 17,500.00 | 0.0% | $ - | 100.0% | $ 17,500 |
| 3 | 3-D FEM Modeling | 37.50% | $ 250,412.00 | 20.0% | $ 50,082 | 65.0% | $ 162,768 |
| 4 | HMA Mixture Design for HMA Overlay Materials | 26.90% | $ 179,588.00 | 15.0% | $ 26,938 | 80.0% | $ 143,670 |
| 5 | Laboratory Test Simulation to Match Model Prediction | 15.90% | $ 105,850.00 | 25.0% | $ 26,463 | 60.0% | $ 63,510 |
| 6 | Development of Draft HMA Mixture Specifications | 3.10% | $ 20,066.00 | 10.0% | $ 2,007 | 75.0% | $ 15,050 |
| 7 | Development of "Decision Tree" Protocol for the Design of Flexible Overlays on Rigid Pavements | 3.00% | $ 19,577.00 | 0.0% | $ - | 10.0% | $ 1,958 |
| 8 | | 0.00% | $ - | 0.0% | $ - | 0.0% | $ - |
| 9 | | 0.00% | $ - | 0.0% | $ - | 0.0% | $ - |
| 10 | | 0.00% | $ - | 0.0% | $ - | 0.0% | $ - |
| 11 | | 0.00% | $ - | 0.0% | $ - | 0.0% | $ - |
| 12 | | 0.00% | $ - | 0.0% | $ - | 0.0% | $ - |
| 13 | | 0.00% | $ - | 0.0% | $ - | 0.0% | $ - |
| 14 | | 0.00% | $ - | 0.0% | $ - | 0.0% | $ - |
| 15 | | 0.00% | $ - | 0.0% | $ - | 0.0% | $ - |
| 16 | | 0.00% | $ - | 0.0% | $ - | 0.0% | $ - |
| 17 | | 0.00% | $ - | 0.0% | $ - | 0.0% | $ - |
| 18 | | 0.00% | $ - | 0.0% | $ - | 0.0% | $ - |
| 19 | | 0.00% | $ - | 0.0% | $ - | 0.0% | $ - |
| 20 | Final Report and Quarterly Reporting | 4.10% | $ 30,689.00 | 0.0% | $ - | 0.0% | $ - |
| | **TOTAL** | 100.00% | $ 668,682 | | $ 105,490 | | $ 449,455 |

Blue text is entered once at the beginning of the project

Green text is updated ever quarter

Black text is automatically updated or static

Project Objectives:

The objective of the research project is to develop guidelines for the NJDOT to properly select flexible pavement "systems" that can provide sufficient pavement life when used on rigid pavements (PCC).

Project Abstract:

Although reflective cracks significantly shorten the pavement service life, there is a lack of a performance-based HMA mixture design specification for routine use to develop HMA mixtures for use as flexible overlays for rigid pavements. Furthermore, neither the NCHRP 1-37A (Mechanistic-Empirical Pavement Design Guide) nor NCHRP 9-17 (Superpave Support and Models Management) specially address laboratory tests or mixture design procedures for the evaluation of reflective cracking, although the recently initiated NCHRP 1-41 (Models for Predicting Reflective Cracking of Hot Mix Asphalt Overlays) led by the Texas Transportation Institute (TTI) will try to provide guidance on these issues. Therefore, there is an urgent need to develop a performance-based HMA mixture design specification for different HMA mixtures for New Jersey, as well as evaluate and characterize new HMA mixtures and additives, to aid in resisting/prolonging the on-set of reflective cracking.

The research study will utilize information from literature searches, surveys, finite element modeling, and extensive field and laboratory testing to develop guidelines for use in the HMA overlay design of composite/PCC pavements. A "Decision Tree" system, that will utilize field forensic testing, as built information, and traffic, will also be developed, which will aid the NJDOT is designing longer life HMA overlays for rigid pavements.

1. Progress this quarter by task:

1a. Field Forensic Testing of Test Site #1 – Route 29

Advanced Infrastructure Design (AID) completed the field forensic study and the collected WIM/AVC information, as well as the PCC cores, have been delivered to Rutgers University. The WIM/AVC information has been analyzed and will be presented at the quarterly meeting. The Coefficient of Thermal Expansion (CTE) testing of the Rt 29 PCC cores has recently begun and test results are not yet available at the time of this report. However, CTE results from Rt 29 should be available for presentation at the quarterly meeting.

1b. Development and Validation of a Rich Bottom Layer (RBL) Spec

The RBL specification provided earlier to the NJDOT was modified. The new name of the Rich Bottom Layer mix is 4.75L70-28, which stands for a 4.75mm HMA mixture, Leveling course that uses a PG70-28 performance grade asphalt binder.

A laboratory validation of the mixture design, using raw materials from Trap Rock Industries Kingston, NJ quarry was conducted. Performance testing of the RBL using three (3) different asphalt binders were conducted; PG64-22, PG70-28, and PG76-22. A mix design was also conducted using the same aggregates to develop a 12.5mm Superpave mix with a PG76-22, which is currently the standard HMA overlay material used for composite pavement rehabilitation. The results of the

Flexural Beam Fatigue and Overlay Tester clearly showed the benefit using a PG70-28 in the RBL mixes, especially at lower intermediate test temperatures. The laboratory testing also showed that the performance of the RBL mixes were superior to the traditional 12.5mm HMA under typical composite pavement loading (i.e. – vertical and horizontal deflections at the PCC joint area).

1c. Evaluation of Surface Course Mixes

Initial testing began on evaluating HMA mixes for use on composite pavements. Work has already been completed on a High Performance Thin Overlay (HPTO) mixture that shows great promise, especially for use on Low to Moderate Heavy Truck Traffic (< 30 million ESAL's). This mixture would be classified as a 4.75mm HMA with a PG76-22 asphalt binder. The HMA requires highly, angular aggregates and a minimum asphalt content of 7%.

Previous testing of a 9.5mm HMA mixture that was placed at the Rt 34N test section did not perform well under laboratory testing. However, after six(6) months, the mixture is showing good performance in the field.

Testing is also proposed to be conducted on OGFC and Novachip mixtures.

2. Proposed activities for next quarter by task:

2a. Continued Evaluation of Surface Course Mixes

Testing should begin soon on the laboratory evaluation of OGFC and Novachip mixes. SMA is also proposed to be evaluated.

2b. Continued Measuring the Coefficient of Thermal Expansion (CTE) for PCC

Continued testing using the Rutgers University CTE device on PCC cores taken from field test sections and from ten (10) different test sites provided by the NJDOT Materials Bureau where cylinders were recently made. The measured CTE, using the AASHTO TP60 test procedure, will be compared to PCC mix properties to try to develop a predictive equation for the estimation of CTE to aid in;

- Better selection of joint sealants;
- Better selection of HMA overlays;
- Better selection of materials for PCC design.

The developed database should provide future guidelines on the expected environmentally induced movements in the NJDOT current PCC design.

3. List of deliverables provided in this quarter by task (product date):
N.A.

4. Progress on Implementation and Training Activities:
N.A.

5. Problems/Proposed Solutions:
N.A.

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| Total Project Budget | $668,682 |
| **Modified Contract Amount:** | |
| Total Project Expenditure to date | $449,455 |
| % of Total Project Budget Expended | 67.22% |

NJDOT Research Project Manager Concurrence: _____ Date: _____